



TITLE:

1. Study site and methods

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1. Study site and methods

The study site is located on an exposed rocky shore of Cape Bansho near the mouth of Tanabe Bay. The bay is a small indentation of $\sim 4 \times 4$ km on the west coast of the Kii Peninsula ($33^{\circ} 41' \text{ N}$, $135^{\circ} 20' \text{ E}$; Fig. 1a, b). The geology of Cape Bansho is made up of a conglomerate belonging to the Toshima Formation of the Pliocene or Pleistocene (Mitsushio et al. 1998). The rocks are not highly consolidated due to the recent age of the stratum, and are easily eroded to form wide shore platforms. A survey area of 4416 m^2 was established on one of these rocky platforms, which projects southwards into the Pacific Ocean (Fig. 1c). The northern landward limit of the platform is a cliff, while the southern end drops steeply into the sea. An elevated zone extends through the middle of the platform from the northwest to the southeast, which is accompanied by a gentle slope on the southwest side and by notches on the northeast side, dividing the study area into an exposed seaward section and landward sheltered section. The survey area ranges between +40 cm and +225 cm above the chart datum. MLWS was +5 cm and MHWS was +183 cm (1985–2010). The mean annual values and the ranges of meteorological and hydrographic parameters around Cape Bansho between 1985 and 2010 were as follows: air temperature, 17.1° C (range, 5.1 – 28.6° C in February and August, respectively); water temperature, 20.7° C (range, 13.2 – 29.1° C in February and August, respectively); and salinity, 34.2 psu (range, 32.7–34.9 psu in September and March, respectively). Data were obtained from the Japan Meteorological Agency (air temperature), the Seto Marine Biological Laboratory of Kyoto University (water temperature), and the Wakayama Prefectural Fisheries Experimental Station (salinity). The study site is often exposed to swells caused by typhoons from July to October, and high waves caused by seasonal winds from the northwest between November and February.

The mollusk fauna of the study site was investigated once a year in April or May from 1985 to 2010. The 4416-m^2 survey area was divided into 69, 8×8 m quadrats (Fig. 1c). One to four researchers recorded all the mollusk species in each quadrat, although opisthobranchs were not searched for until 1994. Only the presence or absence of species

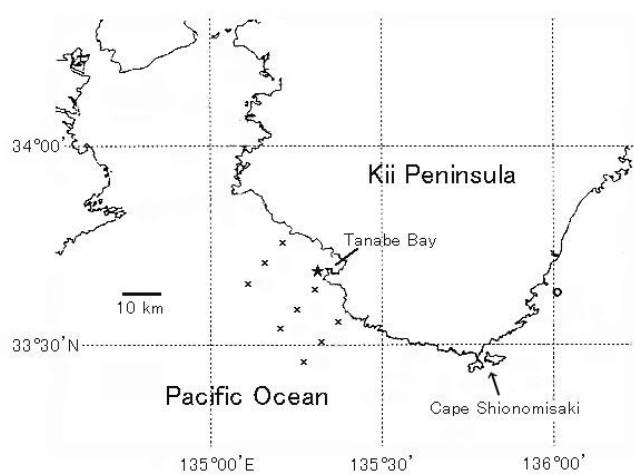
was recorded from 1985 to 1993, whereas the density of each species was evaluated from 1994 to 2010 (Table 9). Each survey was undertaken for 3–6 h during a daytime low tide, around a spring tide. The time spent surveying each quadrat varied from 20 to 60 min, depending on the topography, abundance of algae, number of researchers, etc. Each census continued until the researchers had covered the entire area within each quadrat.

Figure 1.

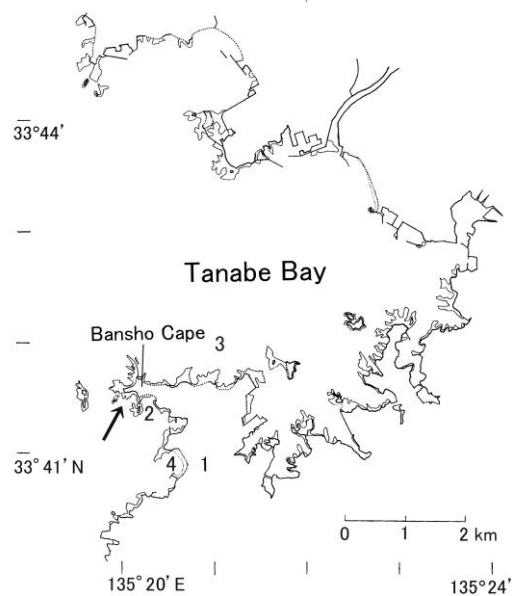
The study site at the mouth of Tanabe Bay (b, arrow) situated on the south-west coast of the Kii Peninsula (a, solid star). A rock platform projecting southward from Cape Bansho was divided into 69 fixed quadrats each of 8×8 m each (c). The crosses in (a) and the numerals in (b) indicate the stations used for meteorological and oceanographic measurements (Table 8). The study area was divided into four subareas (d), i.e., H (high zone, >150 cm above the chart datum), Me (exposed middle zone, 100–150 cm), Ms (sheltered middle zone, 100–150 cm), and L (low zone, <100 cm), based on elevation data (Table 4) and water flow (Table 5). The arrangement of quadrats in (c) corresponds to that of (d). The 69 quadrats were coded using a grid system with alphabetic lettering versus numbers as shown in (d), e.g., the upper-right quadrat is A1.

Figure 1.

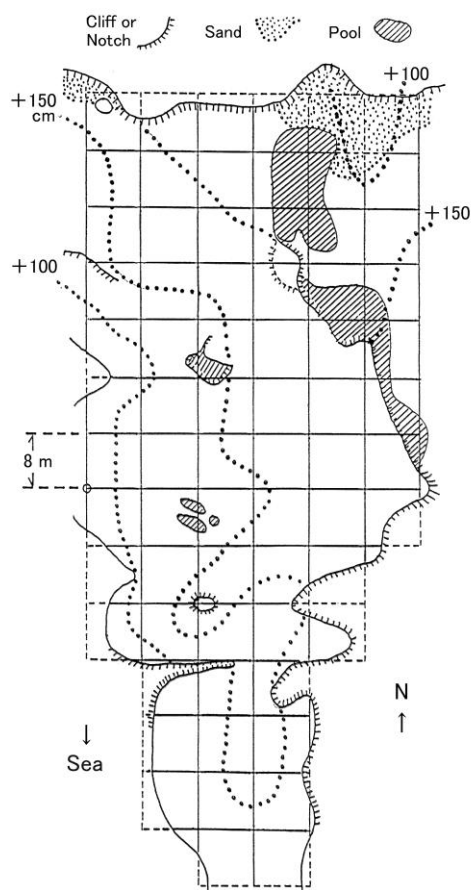
a



b



c



d

